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(NASA-CR-171927) ULTRAVIOLET ABSORPTION TOTAL ORGANIC CARBON ANALYZER FOR RECOVERED SPACECRAFT WATER. FAMILIARIZATION (TRAINING) AND OPERATION MANUAL (WITH ENGINEERING AS-BUILT DRAWINGS IN APPENDIX) N86-71153

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ULTRAVIOLET ABSORPTION

TOTAL ORGANIC CARBON ANALYZER

FOR RECOVERED SPACECRAFT WATER

(REFERENCE NASA CONTRACT NO. NAS9-16846)

(ASTRO PROJECT NUMBER 000707)

FAMILIARIZATON (TRAINING) AND

OPERATION MANUAL

(WITH ENGINEERING "AS-BUILT" DRAWINGS IN APPENDIX)

JULY 1984

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* BILL OF MATERIALS/PARTS LIST - NASA UV ABSORPTION ANALYZER ("AS-BUILT") 25
* DWG # 84-615-146-N, UV ABSORPTION ANALYZER (TOC) INSTALLATION AND PARTS IDENTIFICATION DIAGRAM. ("AS-BUILT")
* DWG # 84-015-144-N, UV ABSORPTION ANALYZER POWER AND SIGNAL WIRING. ("AS-BUILT")
* DWG # SKE 12884-1, SPECIAL FLOW THRU QUARTZ CELL - 100 MM PATH LENGTH ("AS-BUILT")

1. INTRODUCTION

The UV analyzer (ultraviolet absorption spectrophotometer) measures the ultraviolet radiation absorption of organic substances to monitor contamination. Astro's UV analyzers, which were developed based on our measuring technology and experience in the manufacture of automatic infrared analyzers and automatic TOC analyzers over many years, have the following features.

- Measurement by split beams and two wavelengths.
- Unique and reliable design of the UV, optical system employing a semitransparent mirror without a drive mechanism.

Read this entire instruction manual before use for optimum analyzer operation.

2. SPECIFICATIONS

The following is the specifications of Astro's UV absorption analyzer.

2.1 EQUIPMENT SPECIFICATIONS:

* Measuring objective:
  Organic contaminants in water.
* Factor to be measured:
  Turbidity (small non-stationary bubbles) compensated ultraviolet absorbance and ultraviolet (uncompensated) absorbance.
* Measuring range:
  0 - 2 PPM organic contaminants (as KHP = Potassium Acid Phthalate) or approximately 0.05 to 0.10 absorbance units
  Minimum detectable limit: 0.04 PPM or .002 absorbance units
  Absorption converted to that measured in 100 mm path length sample cell. Switch selectable 0-2, 0-4 PPM organics.
* Range Setting:
  Manual switching (front panel) or automatic switching by external signal.
* Measurement period: Continuous.
* Measuring method:
  Split beam, two-wavelength ultraviolet radiation absorption measurement.
  Radiation source; Low-Voltage mercury lamp

Beam	One for measuring absorption and the other for compensating radiation source.
Sample cell	Flow thru type cell.
Wavelength	Absorption measurement (254 nm) - UV Turbidity compensation (546 nm) - Visible
Detector	Photocells (4pcs.)

* Display:
  Indicator (continuous indication)
  Graduations 0 to 1.0 (equally subdivided by 50).

* Construction:
  Drip-proof construction. Structurally supported fiberglass cabinet.
* Dimensions: Approximately 32" High X 24" Wide X 18" Deep (82cm X 61cm X 54cm)
* Weight: Approximately 60 pounds (27kg)

2.2 ENGINEERING SPECIFICATIONS

* Measurement output:
  0 - 1V DC (load resistance 100 K ohms min.)
  4-20 MA DC (500 OHM max load resistance) with built in isolator.

* Power-supply-interruption output:
  No-voltage contact (closed at interruption).

* In maintenance (or calibration) "FAST" response setting..
  Output is a no voltage cantact (closed in maintenance).

* Power supply Requirements::
  110 ± 10V AC, 50/60 Hz, 200 VA. (pump on)

* Sample conditions:
  Flow rate 1 to 96 cc/min via adjustable pump (may be bypassed for higher flows). Maximum recommended flow is 1 LPM.
  Pressure 0.0 to 45 PSIG (0.0 to 3 bar, gauge)
  Temperature 10 to 40°C.

* Installation conditions:
  Ambient temperature 10 to 40°C.
  Ambient humidity 65 ± 20% (RH)
  Location indoor, outdoor (avoid direct sunlight).

2.3 SYSTEM CHARACTERISTICS:

* Repeatability:
  Better than ± 2% of full scale.

* Zero point stability:
  Better than ± 2% of full scale per day.

* Span stability:
  Better than ± 2% of full scale per day.

* Response (T-63%):
  Within 30 seconds (at sample flow rate of 100 cc/min thru cell).

* Response (T-90%)
  Within 50 seconds (at sample flow rate of 100 cc/min thru cell).

* Initial response to change: (T-Dead):
  Less than 10 seconds at 100 cc/min minimum flow thru cell.

* Linearity:
  Better than ± 2% of full scale.

2.4 WETTED MATERIALS LIST: (MATERIALS POSSIBLY IN CONTACT WITH SAMPLE)

* Teflon PFA (Perfluoroalkoxy)
* Stainless Steel (316)
* Ceramic (Aluminum Oxide)
* Rulon "J"
* TFE (Tetrafluoro-Ethylene = Virgin Teflon)
* Kynar
* "C-Flex" (Trademark of Concept Inc.)
* Suprasil Quartz (Far UV silica)

3. MEASUREMENT PRINCIPLE:

3.1 Basic Principle

When a beam with a wavelength in the ultraviolet region passes through a solution including organic substances, part of the radiation energy is absorbed and the intensity of the radiation after passing through the solution is defined by the following equation according to the Lambert-Beer law.

$I = I_0\ e^{**}(-kCL)$ e = natural logrithm

$A = -\ln(I/I_0) = kCL = -\ln(1/T)$

$T = I_0/I$

where A : Absorption

I_0 : Intensity of incident radiation.

I : Intensity of exit radiation.

k : Coefficient of absorption at normal temperature and pressure.

C : Concentration of sample.

L : Thickness of sample layer.

T : Transmittance

At a constant thickness (L) of the sample layer (this is the path length of the sample cell), the intensity of absorption is proportional to the concentration (C) of the solution. Therefore, the concentration of organic compounds in the solution can be determined by measuring the absorbance.

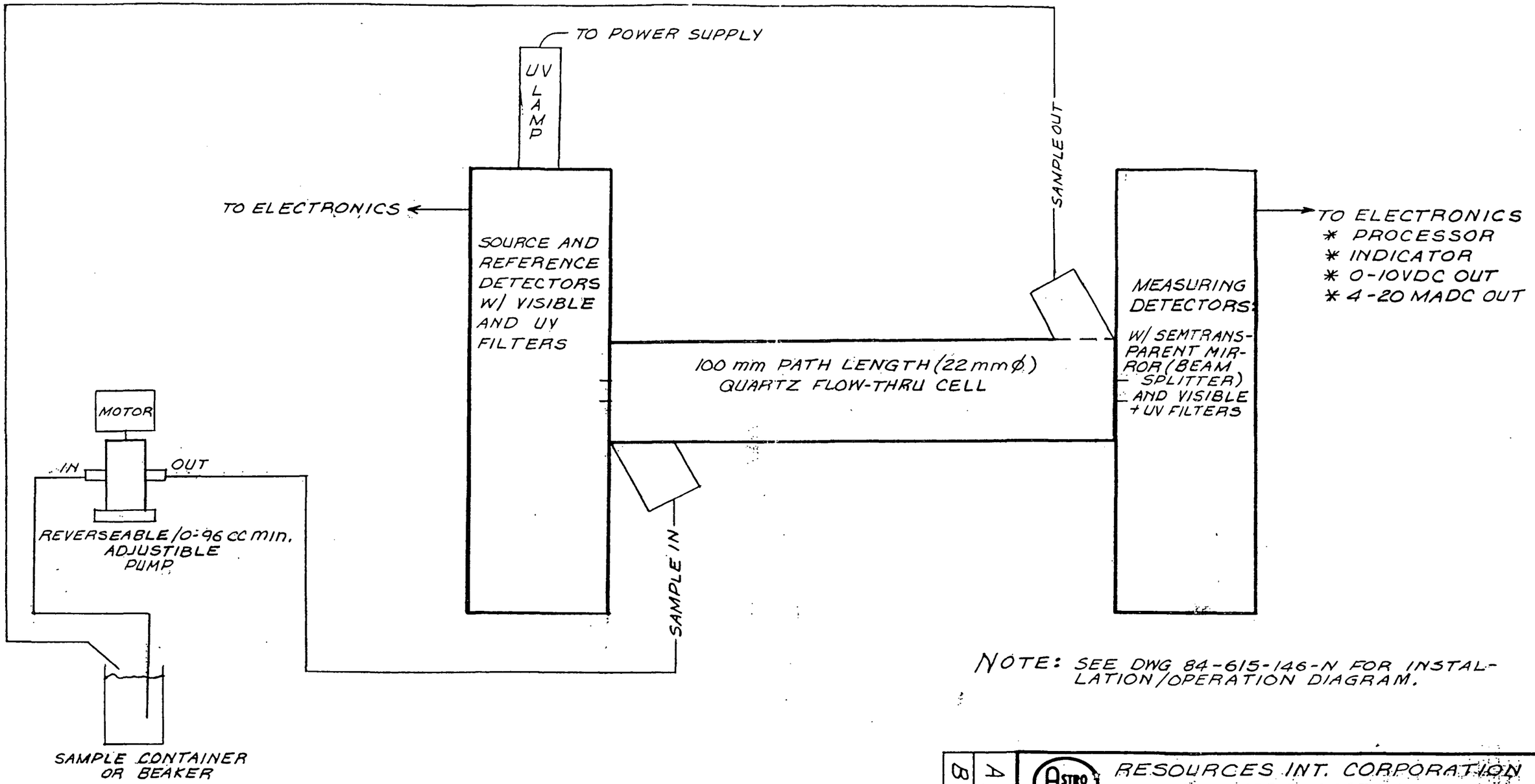
3.2 Measurement Principle of Astro UV Absorption:

See Figure 3.2.1

The Astro UV analyzer employs a split beam, two-wavelength method which uses two wavelengths for compensating turbidity in the measurement of UV radiation absorption and two beams for compensating the variation of the radiation sources in the luminance. (Downstream of the sample cell).

The radiation from the radiation source passes through the sample cell (Dwg # SKE 12884-1 in the Appendix) and divided by a semi-transparent (half silvered) mirror into two beams. Intensities of the UV radiation and the visible light are detected by photocells.

Also, part of the radiation from the radiation sources is directly detected by photocells for the intensity of the UV radiation and the visible light. The four detected signals are processed to continuously indicate and output the UV absorbance. That is, the reading for amount of organic contaminants in the sample, is compensated for any variations in radiation intensity from the UV source or the turbidity of the sample in the cell.



NOTE: SEE DWG 84-615-146-N FOR INSTALLATION/OPERATION DIAGRAM.

(FIG. 3.2.1 SYSTEM BLOCK DIAGRAM)

ALSO SEE DWG. 84-615-146-N FOR INSTALLATION/OPERATION DIAGRAM

B	A	RESOURCES INT. CORPORATION PROJECT: 000707
DCN # 148 TB-ED 7-12-84	DCN # 134 TB-ED 5-3-84	SCALE: NONE · APPROVED BY: · DRAWN BY: GKE DATE: 1-10-84 · REVISED 7-12-84 100 mm PATH LENGTH UV ABSORPTION SYSTEM BLOCK FLOW DIAGRAM NASA PROJECT# NAS9-16846 ASTRO PROJECT# 000707 DRAWING NUMBER SKE-011084-1 · REV B

3.3 TYPICAL CALCULATIONS FOR THE PREPARATION OF CALIBRATION STANDARDS

Absorbances are affected by cell pathlength and the specific compounds in the solution the cell. The Astro UV absorbance analyzer is based on the absorbance measured in a 100 millimeter path length special quartz flow thru cell. For calibration, stable and harmless potassium acid phthalate (hereinafter called KHP, MW = 204.2) solutions are used. The reference to TOC (Total Organic Carbon) is used and is based on the percentage of carbon (35.26%C) in KHP.

To make a 2 PPM TOC (as KHP = 5.67 PPM KHP) standard requires the formulation of a 1000 PPM TOC (as KHP = 2836 PPM KHP) stock solution. This is done by taking 0.2836 grams of KHP and dissolving it in pure deionized and polished water (zero water, organic free with conductivity greater than 18 megohms/cm) to 1 liter total. Subsequently, for 2 PPM TOC (KHP), 2cc (liquid) of this 1000 PPM TOC (KHP) standard diluted to 1 liter total yields the required standard. 4 PPM TOC (KHP), or 0.5 PPM or 1 PPM, etc, can also be made in this manner. Always make standards from dilutions of the high PPM stock solution and not from each other. This eliminates any "zero" offsets due to inadequate zero water. Other soluable compounds can be used in a similar manner.

3.4 TYPICAL SYSTEM RESPONSE TO VARIOUS COMPOUNDS

		PPM TC/TOC OF COMPOUND IN SOLUTION REQUIRED FOR 100% OF FULL SCALE READING
1.	KHP (Potasium Acid Phthlate)	2.0 (Full Scale Calibration Standard)
2.	Acetic Acid	33,333.0
3.	Acetone	74.1
4.	Benzoic Acid	3.70
5.	2, 3 Dimethyl Phenol	9.10
6.	Ethanol	66,666.0
7.	Formic Acid	2564.0
8.	2 - Heptanone	169.5
9.	Noanoic Acid	1666.7
10.	Phenol	5.0

3.5 TYPICAL SPEED OF RESPONSE

- 1 PPM TOC (as KHP) (50% of full scale response) test solution. Suction inlet tube was moved as necessary between test sample and DI (zero water)

CC/MIN APPROXIMATE FLOWRATE THRU CELL	SECONDS T DEAD * (SLOW) #	SECONDS T DEAD * (FAST) #	SECONDS T 63** (SLOW)	SECONDS T 63 ** (FAST)	SECONDS T 90 *** (SLOW)	SECONDS T 90 *** (FAST)
10	25	25	170	210	390	380
20	20	18	75	70	165	120
30	14	12	62	55	130	120
40	13	13	49	45	107	87
50	10	9	40	33	90	80
60	11	8	37	27	65	52
70	9	8	33	24	55	45
80	9	8	27	23	43	42
90	9	6	26	17	42	32
100	8	6	26	17	42	32

* = Time in seconds to the beginning of response from the time sample tube is inserted into new solution.

** Time in seconds to 63% of the final response from the time sample tube is inserted into new solution.

*** Time in seconds to 90% of the final response from the time sample tube is inserted into new solution.

\# Refers to electronic damping (slow-down) of output signal which is used to reduce short term noise. This is changed via the FAST/SLOW selector switch on the front panel.

3.6 SAMPLE TEMPERATURE SENSITIVITY

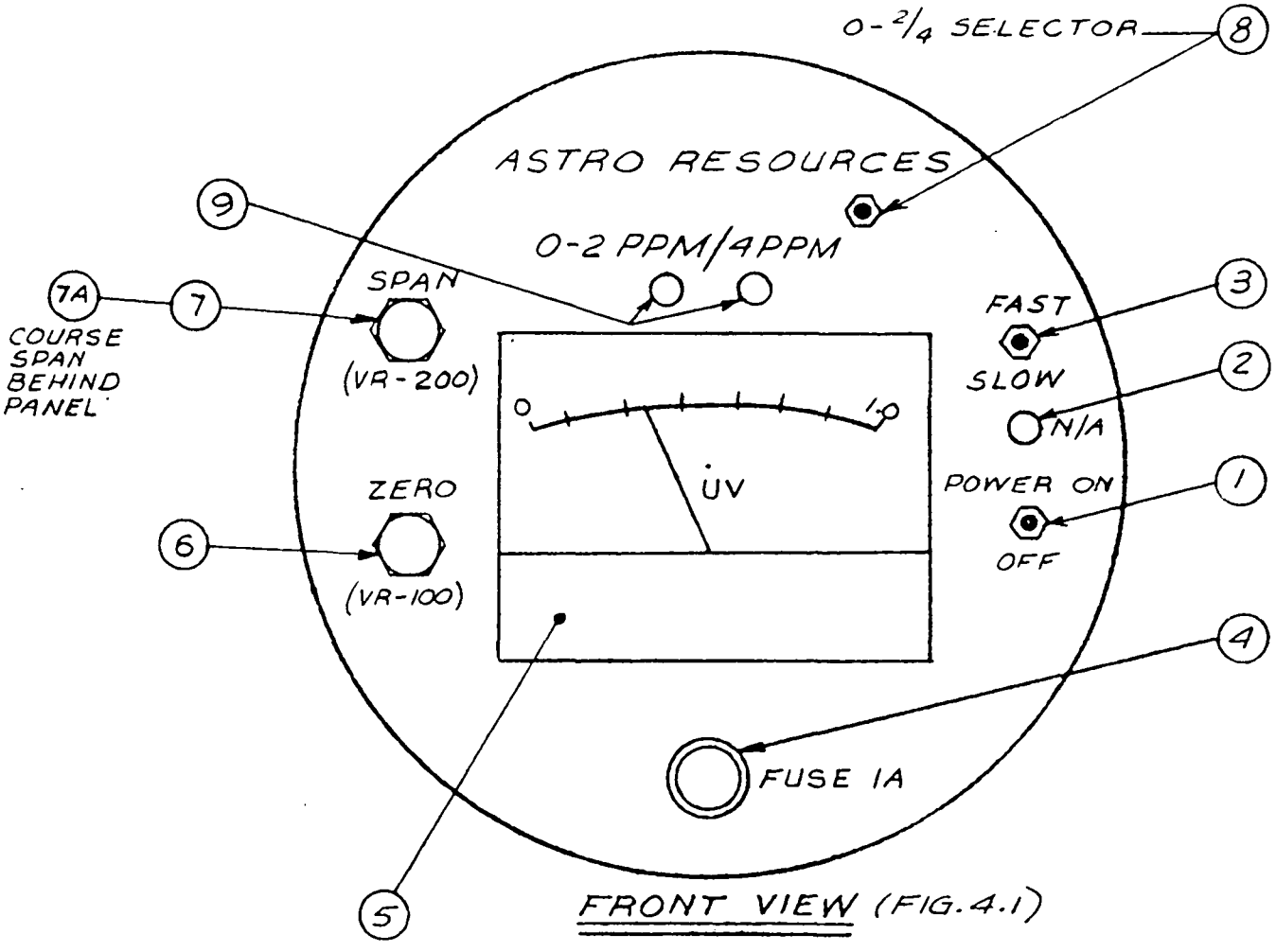
0.2% of scale/deg C change in sample temperature is the maximum observed for KHP standards. No effect was observed for DI water over the range 0^{o} to $71^{o}C$.

3.7 SAMPLE pH EFFECTS

Some effects have been noticed, responses may vary greatly if a reaction occurs due to the pH change. No effect is noticed for DI water pH adjusted over the range 1-13 with pure reagents.

4. DESCRIPTION OF CONTROLS/SIGNAL WIRING

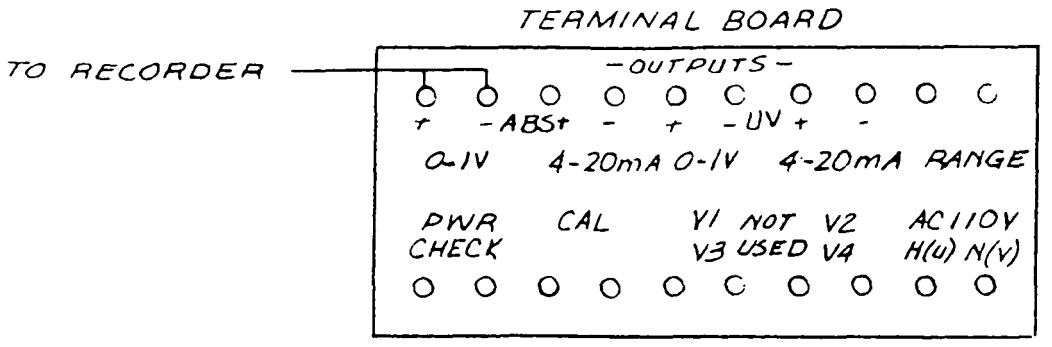
4.1 FRONT PANEL



FRONT VIEW (FIG. 4.1)

(1)	POWER	:	Power switch. On/Off.
(2)	N/A	:	Not used.
(3)	FAST/SLOW	:	This switch is used to speed up or damp the response of the analyzer. SLOW is the normal setting because this eliminates glitches caused by air bubbles, etc. Fast is useful during calibration because it allows immediately electronic response of the system. It also closes a set of contacts (labeled "cal") at the terminal board.
(4)	FUSE	:	Rating 1 A.
(5)	PANEL METER	:	The meter indicates the turbidity compensated UV absorbance. 0-1 units. Adjust to the scale factor required based on your last calibration.
(6)	ZERO	:	A zero adjusting knob.
(7)	SPAN	:	A fine span adjusting knob.
(8)	RANGE SELECTOR	:	A switch for setting the range to 0-2 PPM or 0-4 PPM. When this selector is used, open the remote "RANGE" terminals on the rear terminal board.
(9)	INDICATOR LIGHTS:		A light corresponding to a selected range comes on.

4.2 TERMINAL BOARD



(1) ABS : Outputs turbidity compensated UV absorbance signals of 0 to 1V and 4 to 20 ma.

(2) UV : Outputs UV absorbance signal of 0 to 1 V and 4 to 20 ma.

(3) RANGE : Provides the lower range when short-circuited, and the high range when opened. (For remote control).

(4) POWER CHECK : Outputs a closed contact signal when power goes down. (For remote monitoring).

(5) CAL : Closed contacts ("FAST" response mode) at servicing or calibration. (For remote monitoring).

(6) V1, V2, V3, V4 : Not used - do not use as spare terminals.

(7) AC 110V : Input terminals of power supply.

5. OPERATION

5.1 START-UP AND TYPICAL OPERATION

(1) Be sure that the FAST/SLOW switch is in the "FAST" position.

(2) Turn on the "POWER" switches and wait at least 5 minutes.

(2A) Perform calibration if necessary (See Section 6.3).

(3) Put the FAST/SLOW switch in the "SLOW" position.

(4) Make sure that sample flows thru the cell. (Turn on pump). A pump setting of "5" to the right of the "0" mark is about 50 cc/min. Sample flows from sample in thru the pump - then thru the cell - then to sample out.

(5) Select desired range according to your calibration.

Range Setting: The meter is set to the lower range by short-circuiting the "RANGE" terminals on the Terminal Board. When the "RANGE" terminals are open, the ranges are selectable by the range selector switch on the front panel.

(6) Turn the "POWER" and "CHART" switches of the recorder on (if used) and start measurement.

(7) Read the meter and the output; The panel meter and the "ABS" output read in the range indicated by the front panel indicator. It shows the turbidity compensated UV absorbance.

5.2 SHUT-DOWN PROCEDURE

5.2.1 TEMPORARY SHUT-DOWN - SUCH AS A WEEKEND

(1) Turn on the "FAST" response.

(20 Turn off the "POWER" switch.

(3) Turn off the "POWER" and "CHART" switches of the recorder (if used).

(4) Sample may continue to flow thru the cell.

5.2.2 SHUT-DOWN FOR LONGER PERIODS

(1) Flush clean DI water thru the cell for at least 10 minutes.

(2) Drain the cell by running the pump at a setting of "9" to the left of the zero for at least 5 minutes. This runs the pump flow backwards. Make sure sample in and out lines flow to drain.

(3) Turn on the "FAST" switch.

(4) Turn off the "POWER" switch.

(5) Turn off the "MAIN POWER" switch.

6. INSPECTION, ADJUSTMENT, AND SERVICE

6.1 TYPICAL INSPECTION REQUIREMENTS AND CORRECTIVE ACTIONS

Carry out routine inspections on the following items and immediately take corrective actions if an irregularity is detected by the inspection. This ensures highly reliable measurements.

(1) Inspect the water inlet and outlet lines to ensure that the lines are free from obstructions, leaks, and other defects. Make sure sample water flows steadily.
Replace or clean tubes as necessary. Replace the pump seals if required.

(2) Check the zero and the span with appropriate solutions flowing thru cell. If they deviate, carry out the following.
   a) Zero adjustment. (See Section 6.3)
   b) Span adjustment. (See Section 6.3)
   c) Clean or replace cell. (See Section 6.6)
   d) If unable to zero and/or span, UV source may be defective. Replace and realign lamp and amplifiers per Sections 6.7 and 6.8.

(3) Check if the indicator is hunting. If hunting, check the following.
   a) Fluctuation of power supply voltages.
   b) Trapped bubbles in sample cell.
   c) See 6.1 (5).

(4) Check the measurements recorded on the strip chart recorder. If readings deviates significantly from ordinary values, check the following.
   a) Zero and span. (See Section 6.3)
   b) Sampling system and/or pump.

(5) If the reading is noisy or drifting erratically after all of the above checks, the UV Lamp may be at the end of its useful life. (30,000 hours if run continuously on/off cycling will shorten the useful life somewhat).

a) Using an inspection mirror, and while wearing UV protective goggles, examine the bottom of the lamp thru the viewing port on the bottom of the UV Lamp holder block. The light should be steady. If it flickers, shut power off to the unit for about one (1) hour. Re-start the unit and wait ten (10) minutes - If the lamp still flickers, replace it per Section 6.7.

b) If in doubt, or unit has been in service for one (1) year or more, replace the lamp anyway.

6.2 PREPARATION OF REFERENCE (CALIBRATION) SOLUTIONS

6.2.1 BLANK SOLUTION (OR ZERO STANDARD)

Generally, distilled water is used as a blank or "Zero" liquid. However, because of the low measurement range of this unit, we recommend the use of pure deionized and polished water (conductivity greater than 18 megohms/cm) be used for both "zero" and subsequent standard solutions.

6.2.2 CALIBRATION SOLUTION

To make a 2 PPM TC (as KHP = 5.67 PPM KHP) standard requires the formulation of a 1000 PPM TOC (as KHP = 2836 PPM KHP) stock solution. This is done by taking 0.2836 grams of KHP and dissolving it in pure deionized and polished water (zero water, conductivity 18 megohms/cm or greater) to 1 liter total. Subsequently, for 2 PPM TOC (KHP), 2cc (liquid) of this 1000 PPM standard diluted to 1 liter total yields the required concentration. 4 PPM TOC (KHP), or 0.5 PPM or 1 PPM, etc, can also be prepared in this manner. Always make standards from dilutions of the stock solution and not from each other. This eliminates any "zero" offsets due to inadequate zero water.

6.3. ZERO AND SPAN CHECK (ANALYZER ALREADY RUNNING - SEE SECTION 5)

(1) Set the "FAST (cal)/SLOW (normal)" switch to "FAST".

(2) Flow zero water thru the cell via the pump for approximately 5 minutes at 50 cc/min minimum flow, or until reading is steady.

(3) Adjust the zero adjustment knob so that the reading of the meter will be zero.

(4) Reverse the pump (set to "5 left") to drain the cell.

(5) Run the pump forward (pump left to right) again and introduce span solution. After reading stabilizes adjust course (VR-300, behind front panel) span and fine (VR-200, on front panel) span pots for appropriate reading. See Appendix "As Built" Drawings for pot locations.

(6) Repeat the above steps (2) thru (5) at least two times or until the readings reproduce within 2% of scale.

(7) Check intermediate points if desired. Linearity should be ±2% of scale or better.

(8) Reverse the pump to drain calibration solution out of cell. You are now ready for normal operation.

(9) Put the "FAST/SLOW" switch to "SLOW".

6.4 You may now want to generate a calibration "curve" or determine relative responses to various other compounds by flowing them thru the cell and noting the reading after stabilization.

6.5 SAMPLE CELL CLEANING

Generally the sample cell can be cleaned by flushing the cell with clean DI water. If the stains or coatings are stubborn, flush the cell with dilute solvent (~10 volume percent acetone, alcohol, etc.) followed by a thourough DI water flush and recalibration.

Sometimes, removal of sample cell is indicated for a solvent soak or possibly an ultrasonic wash. Since this is an extreme measure, a new sample cell should be considered.

6.6 SERVICING SAMPLE CELL

6.6.1 REMOVAL OF SAMPLE CELL

(1) Switch the "FAST/SLOW" response switch to "FAST".

(2) Flush the cell with DI (zero) water for at least 5 minutes.

(3) Reverse the pump to drain the cell completely. Follow shutdown preocedure 5.2.2.

(4) Remove the aluminum foil (ambient light shield) from the cell and input output extensions. See Drawing # 84-615-146-N, Installation and Parts Identification Diagram in the Appendix.

(5) Carefully cut the "tie-wraps" (nylon locking clamps) used to clamp the flexible tubing (C-Flex) interface to the 1/4" O.D. extensions of the quartz cell at 2 places, in and out.

(6) Carefully remove the flexible tubing. Set tubing aside.

(7) While holding the cell, loosen the 4 cell adjustment screws enough to let the cell free. **CAREFUL! THE CELL IS FRAGILE!.**

(8) Clean or replace the cell. Check for cracks.

6.6.2 INSTALLATION OF SAMPLE CELL

(1) Center position the rear of the sample cell (inlet tube on bottom) over the white teflon washer attached to the source block.

(2) Carefully position the detector block and tighten the adjusting screws only enough to hold in place.

(3) Center hole in detector block over cell window (flat end facing you). Align the cell so that the outlet (where it meets the cylinder of the cell) is as vertical as possible. This will ensure that any entrained air bubbles in the sample exit without getting caught up in the cell. Note that the exit end of the cell holder is already tilted up slightly by the mounting.

(4) Carefully snug the adjustment screws just tight enough so the cell does not move. Overtightening could damage the cell.

(5) Reinstall the inlet and outlet tubes by slipping new pieces of (C-Flex) flexible tubing over the I/O tubes. Install new "tie-wraps" to ensure proper seal.

(6) Cover the entire cell surface including 3-4 inches beyond the I/O connections with aluminum foil.

(7) Check to make sure none of the exposed detector and preamp electronics contacts any of the foil.

6.7 REMOVAL AND REPLACEMENT OF UV SOURCES (MERCURY LAMP)
(Also See Dwg. 84-615-146-N Installation and Parts I.D.)

(1) Turn the main "POWER" switch off. Note: Its a good idea to have zero (DI) water in the cell. Follow shutdown procedure (5.2.2).

(2) Disconnect the inline power supply plug leading to the lamp.

(3) Loosen the mercury lamp fastening thumb screw on the lamp holder, and draw out the lamp.

(4) Insert a new mercury lamp into the lamp holder.

(5) Turn the "POWER" switch on. Put the "FAST/SLOW" response switch in "FAST". Wait at least 5 minutes. Make sure zero water is in the cell.

(6) Using the zero and span pots, adjust the meter to read approximately 1.0 (100%).

(7) Slowly rotate and move lamp up/down to get a **MINIMUM** reading on the meter. If reading drops below zero, readjust zero and span pots as necessary or switch to low sensitivity.

(8) Once you've achieved minimum reading, gently tighten the thumb screw. Do not over tighten as you could damage the lamp.

(9) Realign the main amplifier output. (Next Section).

6.8 ALIGNMENT OF THE MAIN AMPLIFIER

(Also See Drawings 84-615-146-N and 84-015-144-N)

Normally the alignment of the main amplifier is not necessary. However, alignment is recommended after 1 year continuous operation, when the lamp is replaced, or when the cell is removed or serviced.

(1) Put the "FAST/SLOW" switch in the "FAST" position.

(2) Make sure DI (zero) water is in the sample cell. The DI water should have flowed thru the cell for at least 5 minutes, or long enough for the reading to stabilize as low as possible.

(3) Also, make sure the unit has been on (including lamp) for at least 30 minutes. This is to ensure stabilization.

(4) Set the slide switch on the process board (main amplifier board) to "1" and turn the VR1, also on this board, fully counterclockwise.

(5) Turn the "ZERO" pot (VR-100) on the front of the panel so that the meter registers 0.7.

(6) Set the slide switch to "2" and turn the VR2 so that the meter registers 0.7.

(7) Set the slide switch to "3" and turn the VR3 so that the meter registers 0.7.

(8) Set the slide switch to "4" and turn the VR4 so that the meter registers 0.7.

(9) Return the slide switch to positon "5" ("M")..

(10) Put the "FAST/SLOW" switch back in the "SLOW" position.

(11) Calibrate unit per Section 6.3.

7. FAILURE MODE AND EFFECT ANALYSIS

There are 7 (seven) main components to the UV/Absorption Analyzer. Each is discussed below. The following remarks apply when noted:

R1 Personnel safety - Remove power and repair immediately.

R2 Equipment damage - Test component or interfacing equipment.

R3 Equipment integrity - Must be fixed to continue.

R4 No immediate effect - Can continue.

	COMPONENT	FAILURE MODE - AND EFFECT	CRITICALITY
7.1	SAMPLE PUMP	SEAL FAILURE - LEAKAGE AND AIR SUCTION CAUSING FLOODING AND/OR FAULTY READINGS.	R1, R2, R3
		MOTOR FAILURE - LOSS OF ANALYSIS SAMPLE.	R3
7.2	"CONVERTER" POWER SUPPLY	NO OUTPUT - POWER SUPPLY TO VOLTAGE AND CURRENT OUTPUT AMPLIFIERS, LOSS WILL ELIMINATE OUTPUT SIGNALS.	R3
7.3	"TIMER" POWER SUPPLY	NO OUTPUT - POWER SUPPLY TO MAIN AMPLIFIERS AND DETECTORS.	R3
7.4	UV LAMP POWER SUPPLY	NO OUTPUT - POWERS UV SOURCE	R3
7.5	UV LAMP	NO OUTPUT - UNABLE TO PROVIDE UV ENERGY FOR MEASUREMENT. -NO READING,	R3
		ERRATIC OUTPUT - PRODUCES NOISY AND DRIFTY SIGNAL.	R4
7.6	SAMPLE CELL	BREAKAGE - UNABLE TO HOLD SAMPLE FOR ANALYSIS.	R3, R1
		LEAKAGE - INSUFFICIENT SAMPLE IN CELL FOR PROPER ANALYSIS. EXCESSIVE LEAKAGE	R4
		COULD CAUSE FLOODING IN THE ENCLOSURE.	R1
7.7	MAIN AMPLIFIER	NO OUTPUT - ANALYSIS NOT POSSIBLE	R3
7.8	TIMER BOARD	NO OUTPUT - ANALYSIS NOT POSSIBLE	R3
7.9	V/A CONVERTER	NO OUTPUT - NO CURRENT OUTPUT AVAILABLE	R4

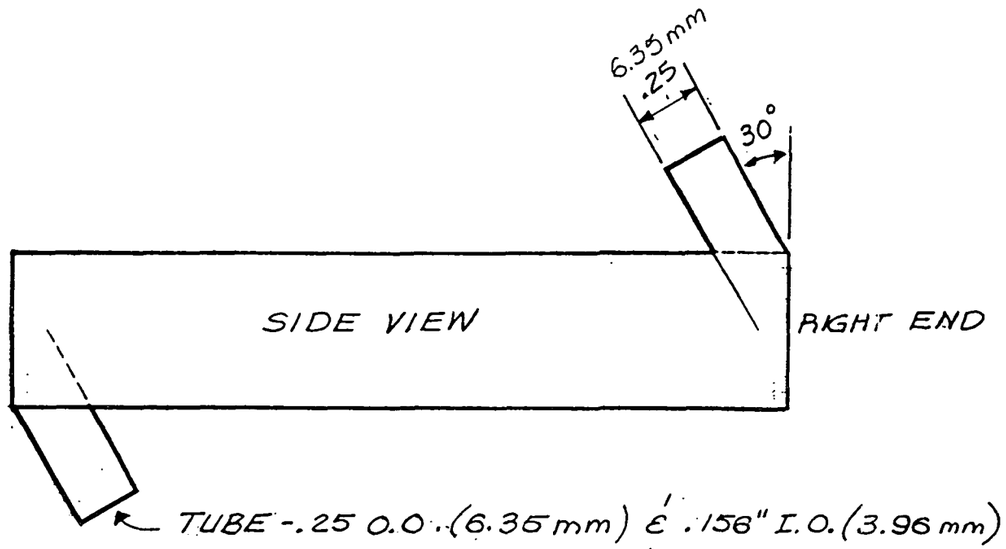
APPENDIX

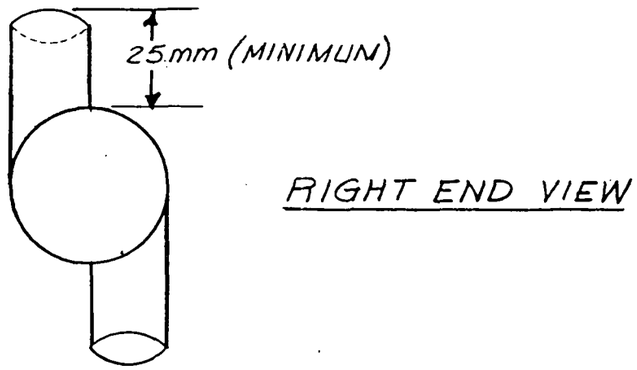
NASA NAS9-16846 (ASTRO 000707)

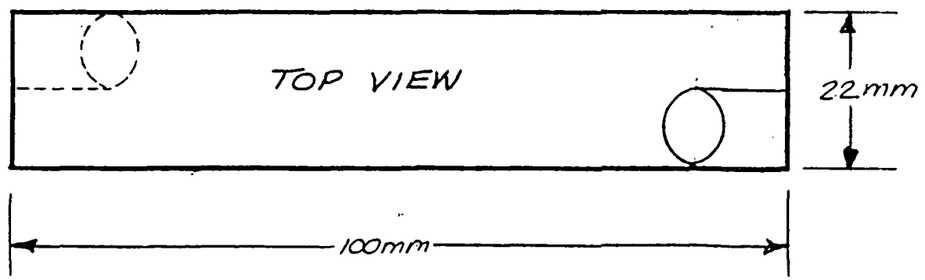
UV ABSORPTION ANALYZER PARTS LIST

(Referenced Dwgs. 84-015-144-N, and 84615-146-N.
for "MARK" Numbers)

MARK #	ASTRO PART #	DESCRIPTION	QTY
1	NUVA-1001	UV Lamp (L937-03, UB161-111-TY)	1
2	NUVA-1002	UV Lamp Power Supply (C940, UB154-111-TY)	1
3	NUVA-1003	Fuse 1A	1
4	NUVA-1004	Fuse 5A	1
5	NUVA-1005	Process P. C. Board (Main Amp) (UB147-1-1-TY)	1
6	NUVA-1006	V/A Circuit Board (UB149-131-TY)	1
7	NUVA-1007	Timer (Cleaning) P. C. Board (UB151-101-TY)	1
8	NUVA-1008	Timer Power Supply (±15VDC-Calex)	1
9	NUVA-1009	Converter Power Supply (±12VDC-Calex)	1
10	NUVA-1010	Detector P. C. Board (UV158/160-TY)	4
11	NUVA-1011	Flow Thru Sample Cell - Quartz 100 MM Path Length - 22 MM diameter. Offset inlet/outlet.	1
12	NUVA-1012	1/4" O.D. "C-Flex (TM)" Tubing - Cut to Required Length	6/inches
13	NUVA-1014	1/8" O.D. PFA Teflon Tubing - Cut to Required Length	4/ft.
14	NUVA-1015	Tie-Wrap Nylon Clamps	A/R
15	NUVA-1016	1/8" X 1/8" Tubing (PFA Teflon) Bulkhead Union	4
16	NUVA-1017	Sample Pump W/Motor 0-±96 cc/min, (RPG-150-2CKC)	1/each
16A	NUVA-1018	Pump Seal Kit Teflon/Rulon	A/R
17	NUVA-1019	Reinforced Fiberglass Cabinet	1
18	NUVA-1020	Power Cord	1

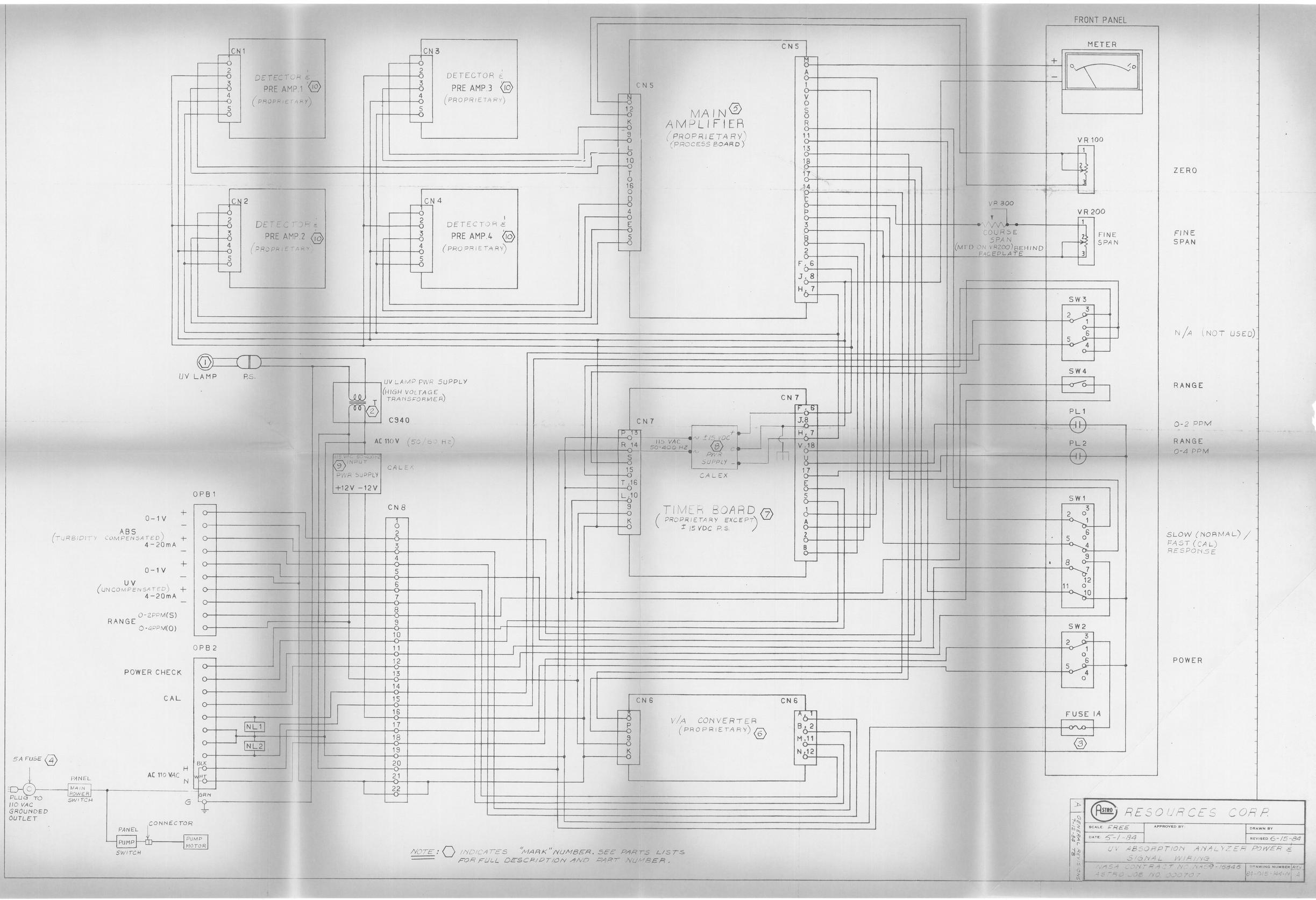






NOT TO SCALE

A	ASTRO RESOURCES INT. CORPORATION		
DCN # 149 T8-EE 7-13-84	SCALE: NONE	APPROVED BY:	DRAWN BY T. BYRD
	DATE: 1-28-84		REVISED
	FLOW-THRU QUARTZ (FAR UV SILICA - SPECTROSIL) CELL - 100 mm PATH LENGTH		
	NASA CONTR. # NAS9-16846 ASTRO PROJECT # 000707	DRAWING NUMBER SKE 12884-1	REV A

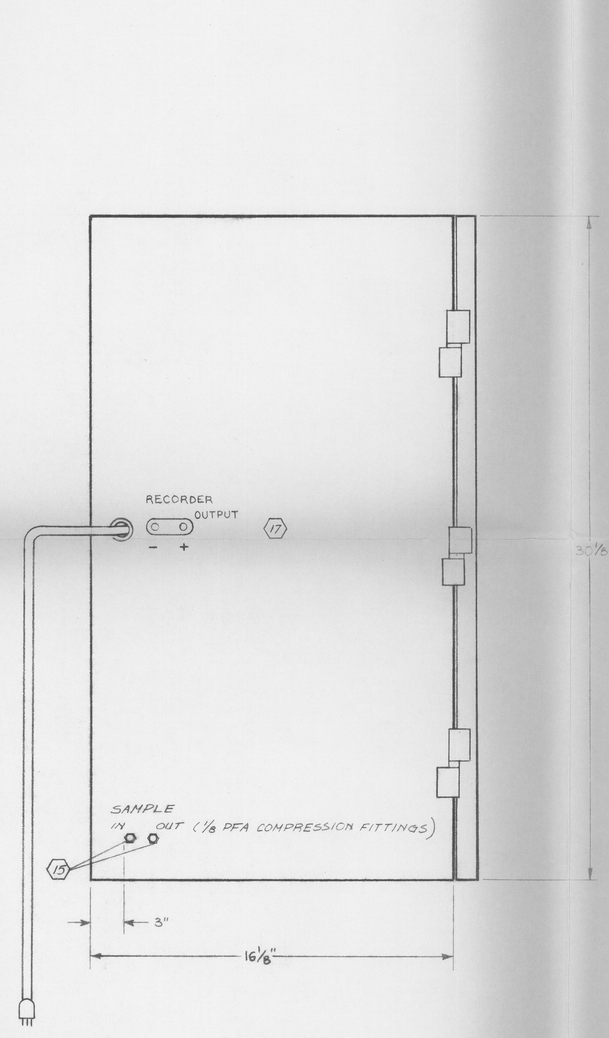


NOTE: ⬡ INDICATES "MARK" NUMBER. SEE PARTS LISTS FOR FULL DESCRIPTION AND PART NUMBER.

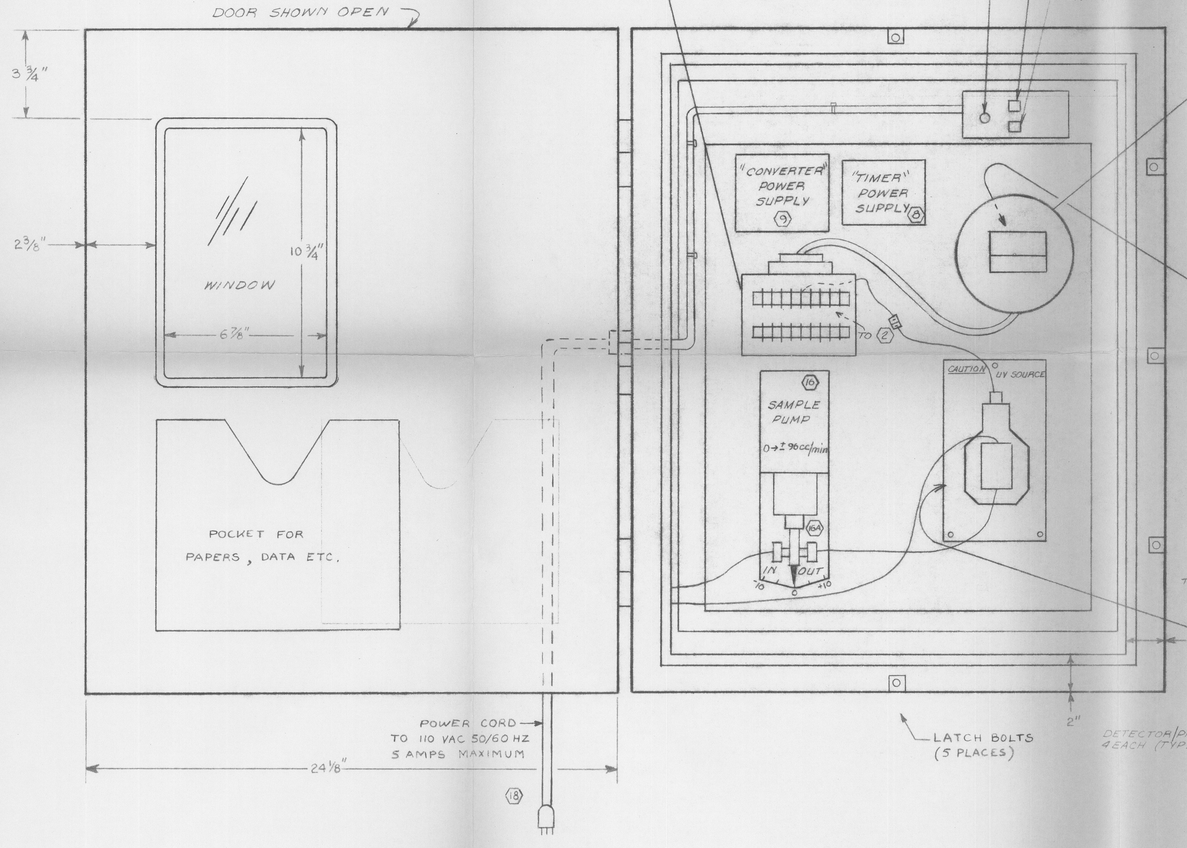
ASTRO RESOURCES CORP.		
SCALE: FREE	APPROVED BY:	DRAWN BY:
DATE: 5-1-84		REVISED 6-15-84
UV ABSORPTION ANALYZER POWER & SIGNAL WIRING		
NASA CONTRACT NO. NAS9-16845 ASTRO JOB NO. 000707	DRAWING NUMBER: 84-015-44-N	REV: A

A — GENERAL REVISIONS — 7-15-84 RB

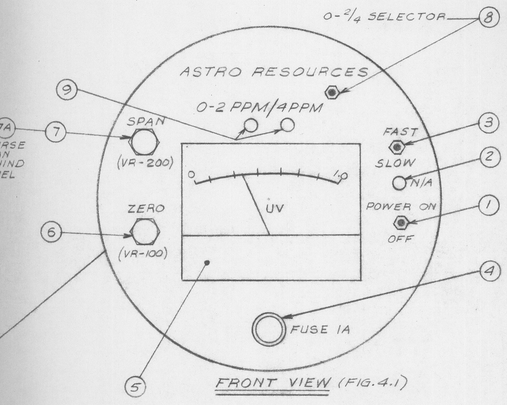
(FOR EXPLANATION OF CONTROLS, SEE SERVICE MANUAL)



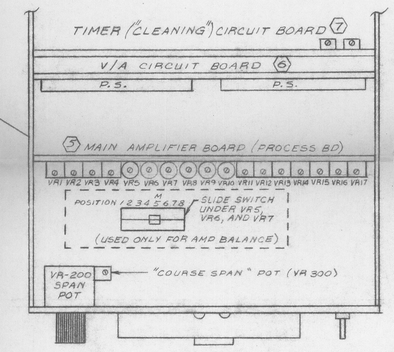
LEFT SIDE VIEW



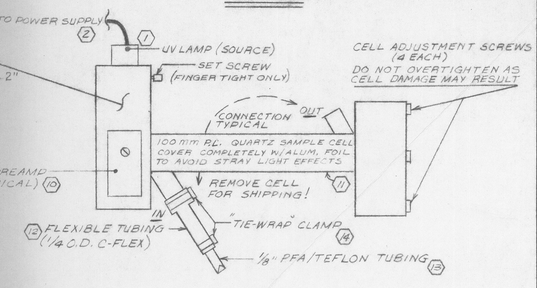
FRONT VIEW



FRONT VIEW (FIG. 4.1)



TOP VIEW



LEFT SIDE VIEW

NOTE

⬡ INDICATES "MARK" NUMBER - SEE PARTS LISTS FOR FULL DESCRIPTION AND PART NO.

ASTRO RESOURCES INT. CORPORATION

SCALE:	APPROVED BY:	DRAWN BY: T.BYRD
DATE: 7-9-84		REVISED

UV ABSORPTION ANALYZER (FINAL BREADBOARD DESIGN) INSTALLATION & PARTS IDENTIFICATION DGM.

NASA CONTRACT NO. NAS9-16846
ASTRO JOB NO. 000707

DRAWING NUMBER 94-615-146-N

REVISIONS: DCN # 160, 8-15-84, "A"

22X24 PRINTED ON NO. 1000H CLEARPRINT